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the works in connection with geodesy in Germany. He has also published some detailed theoretical investigations on this subject, viz. "Ueber die Projection der Land- und Himmelskarten," 1855 (*Astronomische Nachrichten*, No. 983); "Ueber Gradmessungen," 1856 (*Astronomische Nachrichten*, No. 1022); "Studien über Höhere Geodäsie" (1869).

Bremiker died, after a short illness, on March 26, 1877. He was elected an Associate of our Society on May 12, 1848. For the above account of Dr. Bremiker's life and works we are indebted to the kindness of Dr. Winnecke, Director of the Strassburg Observatory.

Eduard Heis was a native of Cologne, where he was born on the 18th of February 1806. He completed his education at the University of Bonn in 1827, in which year he became a teacher of mathematics and physics in the Friedrich Wilhelm Gymnasium at Cologne, where he resided during the succeeding ten years. His talents as a teacher having become known to the authorities of the High School at Aix-la-Chapelle, he was induced, in the year 1837, to accept the position of principal master for mathematics, physics, and chemistry in that school. Here he remained till 1852, to the advantage of those who came under his instruction, and his careful method of teaching made him popular among his pupils. It was while fulfilling his duties at this establishment that his acuteness of vision led him to undertake that long series of records of the relative brightness of the stars, as viewed with the unassisted eye, which formed the materials for that excellent and standard catalogue of stellar magnitudes contained in his *Atlas Cœlestis Novus*. During this period he also found ample opportunities for observing various other occasional celestial phenomena, especially of the zodiacal light, and of casual meteors, bolides, or the periodic recurrences of meteor showers. In 1852 Dr. Heis was transferred to Münster, in Westphalia, having received the appointment of Professor of Mathematics and Astronomy in the Royal Academy of that city. This office, in conjunction with that of Director of the Observatory, he retained to the end of his life.

Dr. Heis became known as a scientific writer soon after he completed his studies at the Bonn University. He employed his leisure hours between his ordinary scholastic duties at the Cologne Gymnasium chiefly in the study of botany, and his first published paper in 1828 was devoted to a botanical investigation "Ueber die Structur der Pflanzenzellen." Other papers relating to the same branch of science followed, and for some time this was evidently his chief recreative pursuit. He may possibly have taken an occasional interest in the appearance of irregular celestial phenomena, but we can find no record before 1833 bearing even slightly on his future astronomical eye-observations; and it is tolerably certain that at this time his thoughts were

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little occupied on astronomy as a subject of research. In 1833 he commenced his notes on the appearance and direction of motion of shooting stars. It may be interesting to remark that his first recorded observation of a meteor was made on October 2 of that year, at seven in the evening, when he noticed, from Steinheim, near Hanau, a fireball appear near *α Andromedæ*, passing through *Cygnus* to near *Vega*, where it exploded. His second recorded observation was not made till August 10, 1839, between which date and November 1847 occasional meteors only were observed by him, a few in almost every year. In 1847 Dr. Heis published his first paper on the meteors observed to that date, and this has been followed by several others at frequent intervals in connexion with meteoric astronomy. Before his sudden death Dr. Heis had collected all his meteor-observations from 1833 to 1875, and arranged them in a convenient form for publication in one volume, forming vol. ii. of the *Publications of the Royal Observatory at Münster*, and the revision of the greater number of the proof-sheets was made by him before they were passed for press. This valuable work, *Resultate der in den* 43 *Jahren* 1833–1875 *angestellten Sternschnuppen Beobachtungen*, contains the right ascension and declination of the points in the heavens of the beginning and ending of the track of each meteor, which on some days amounted to several hundreds. No one more than he took greater pleasure in recording any special observations of meteors, especially of the periodical showers belonging to the principal August and November streams, the full details of which are contained in this volume. Dr. Heis was also an assiduous observer of the aurora borealis and the zodiacal light, and he never willingly lost an opportunity of increasing the number of observed facts relating to these phenomena at successive appearances. The results of his observations and investigations on these subjects have been published from time to time in various scientific serials; but those on the zodiacal light have been collected and discussed by Dr. Heis in the first volume of his Observatory publications, which appeared in the year 1875.

Professor Heis has at various times paid particular attention to the variability in the magnitude of the larger periodic stars; among these *Algol*, *Mira Ceti*, and χ *Cygni* were favourite objects of observation. Their periodical variations of magnitude were carefully noted by him, and his deduced periods of variability of these stars are considered to be most trustworthy. He was indebted to his friend Professor Argelander, whose experience in the observation of stellar magnitudes was perhaps greater than that of any other astronomer, for some valuable suggestions as to the best method of making the comparisons of magnitude on different days, and which he advantageously adopted in his observations.

But the work which will connect the name of Professor Heis with the history of astronomy of the present century is un-

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doubtedly his *Atlas Cœlestis Novus*, consisting of twelve maps, accompanied by an index-catalogue arranged according to the constellations, the result of a twenty-seven years' continuous examination of the relative magnitudes of nearly all the stars visible to the naked eye from the latitude of Münster. In presenting these observations, Heis has evidently used Argelander's *Uranometria* as his working catalogue, as he has adopted the same form and arrangement of the results, and in some cases he has apparently been influenced by the previous magnitudes of Argelander; but though in general the corresponding magnitudes in the two works are in agreement, there is every probability that Heis's values as a whole are independently estimated, for he remarks that the magnitudes in the *Atlas Cœlestis Novus* were derived from an independent method devised by himself, and that he endeavoured on all occasions to avoid any possible influence from the magnitudes of stars previously published. In the Atlas the varying luminosity of the Milky Way is represented in different shades with a good effect, but the insertion of the figures of the constellations in addition to the boundaries is rather distracting to the eye, and for this reason it would have been better had they been omitted. Dr. Heis's unusually acute vision enabled him to see smaller stars with the unassisted eye than most ordinary observers, and it is rather remarkable that he should have been able to note the magnitudes of 2,153 stars which had been passed over by Argelander, of which 1,821 are smaller and—what is more remarkable—34 greater than the sixth magnitude. The whole number of stars contained in the catalogue whose magnitudes are recorded is 5,421. The great excess of stars in the *Atlas Cœlestis Novus* over those in the *Uranometria*, especially of the $6\frac{1}{2}$ magnitude, gives to the former a value peculiar to itself. It appeared in 1872 as an atlas in folio, with the index-catalogue in octavo. Its publication brought Dr. Heis's name prominently before astronomers out of Germany, and attention was thus more directed to this hard-working professor, whose continuous labours had hitherto only been appreciated by those who took a common interest with him in the observation of meteors, the aurora borealis, the zodiacal light, and other occasional astronomical phenomena. On January 9, 1874, his important services were recognised by the Royal Astronomical Society by electing him an Associate.

Professor Heis was the editor of a German astronomical periodical entitled *Wochenschrift für Astronomie*, which, though well-known in Germany, had only a limited circulation out of that country. Several of his contributions to meteoric astronomy and other subjects have appeared in that journal, which accounts for so few of them having come under the eyes of English astronomers. Some of his most valuable papers may, however, be found in the *Astronomische Nachrichten*, the *Bulletins de l'Académie Royale de Bruxelles*, and a few other serial publications which are generally available for reference. His sole

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contribution to the *Monthly Notices* is a list of radiant points of meteors observed within the eleven years preceding 1860. He is also the author of a popular collection of examples and problems in general arithmetic and algebra, which has passed through a considerable number of editions in Germany.

Professor Heis remained an active worker in our science to the last, and it has been already remarked that at the time of his death he was engaged in passing his collection of meteor observations through the press. He died suddenly of apoplexy on the 30th of June 1877, in the seventy-second year of his age. His name will remain honoured as representing a zealous, hard-working, and careful observer, who, regardless of personal inconvenience, has accumulated a vast store of results of great practical utility to his fellow-observers, as well as to the science of astronomy generally. E. D.

Urbain Jean Joseph Le Verrier was born on March 11, 1811, in the department of the Manche. Of his earlier education we have no record; but at twenty years of age he joined the Ecole Polytechnique at Paris, where he studied two years, and on leaving the institution in 1833 had attained a rank which entitled him to make choice of one of the higher public services, and he accordingly became attached by preference to the "Administration des Tabacs," as engineer. In this position his duties also involved employment in the laboratory, and it thus probably arose that the first scientific papers published in his name were upon chemical subjects, viz. "Sur les combinaisons du phosphore avec l'hydrogène" and "Sur les combinaisons du phosphore avec l'oxigène," which appeared in the *Annales de Chimie* in 1836 and 1837 respectively. Notwithstanding, however, that Le Verrier's earlier memoirs were upon subjects connected with a department of science at that time distinct from astronomy, it is evident, from a very interesting note communicated by Sir George Airy to M. Tresca a few months since, that Le Verrier's attention had been directed to the particular science in which he has left so illustrious a name previously to his joining the "Administration des Tabacs" —or during his course of study at the École Polytechnique. Sir George states that he was probably Le Verrier's oldest scientific friend—that he believes his name had been known to him since the year 1832, about which time the Astronomer Royal's researches on the motions of the Earth and *Venus* were made public.

Le Verrier's first astronomical memoir was presented to the Academy of Sciences on September 16, 1839. It is entitled "On the Secular Variations of the Elements of the Orbits of the Seven Principal Planets," and was printed *in extenso* in the additions to the *Connaissance des Temps* for 1843, which appeared in August 1840. Thus Le Verrier's first memoir has reference to one of the most interesting and important questions in astronomy,